



My NASA Data

Volcanic Eruptions Story Map

Lesson Plan

Purpose: Students will explore the formation and impacts of ash and aerosols from volcanic eruptions around the world. They will investigate how ash and aerosols are produced from volcanic eruptions and how volcanoes are formed. In the Elaborate stage, students will graph the concentrations of aerosols from a volcanic eruption over time. In the Evaluate stage, students will use evidence-based reasoning to determine the impact that ash and aerosols produced from volcanic eruptions may have on the human ecosystems.

Grade Level: 7 – 12 Time: 2 – 50-minute class periods	Lesson Objectives: <ul style="list-style-type: none">• Students will analyze maps and time series data to understand changes from volcanic eruptions.• Students will construct data-based explanations and conclusions.• Students will compare multiple variables as they analyze aerosol data from volcanoes.• Students will consider the impact of volcanoes on the human ecosystem.	Sphere(s): <ul style="list-style-type: none">• Geosphere• Atmosphere• Biosphere
Phenomena NASA Connection: <p>When a volcano erupts, it can wreak just as much havoc in the air than on land. The expanding plume of ash that rises into the atmosphere is a danger to aircraft and can damage engines, causing them to fail midflight. Because the plumes often look like ordinary rain clouds on radar and to a pilot's eye, they can be difficult to detect. Out of caution, smoke-spewing volcanoes are given a wide berth, leading to costly flight delays and cancellations.</p> <p>To help improve the flow of air traffic, NASA scientists are using data collected by the Earth-observing Suomi NPP satellite to map the full three-dimensional structure of volcanic clouds. By measuring the location and height of particles within the cloud, as well as the amount of sulfur dioxide gas in the air, scientists can create improved models of weather patterns, allowing a more accurate forecast of where the hazardous ash is spreading—information air traffic managers can use to reroute flights and keep passengers out of harm's way. Watch the video to learn more.</p>		



Essential Questions:

1. How do volcanoes influence changes in the atmosphere?
2. How do aerosols and ash produced from volcanoes influence the human ecosystem?
3. How are volcanoes formed?

NGSS Performance Expectations:

- **5-ESS2-1** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
- **MS-ESS2-2** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
- **MS-ESS3-3** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- **HS-ESS2-2** Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth Systems.

Science and Engineering Practices:

Developing and Using Models

Develop and use a model to describe phenomena.

Constructing Explanations and Designing Solutions

Apply scientific principles to design an object, tool, process or system

Analyzing and Interpreting Data

Analyze and interpret data to determine similarities and differences in findings

Disciplinary Core Ideas:

ESS2.A Earth Materials and Systems

Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.

ESS3.B Human Impacts on Earth Systems

Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.

Crosscutting Concepts:

Stability and Change

Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.

Systems and System Models

Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy, matter, and information flows within systems.

Cause and Effect

Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.



NCTM Math Standards: n/a

Cross-curricular Connections: National Geography Standards

How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.

STEM Career Connection:

- **Geologist** – A Geologist is one who studies the material that constitutes the Earth, the processes that shape it, and its history.
- **Geotechnical Engineer** – A Geotechnical Engineer is a type of civil engineer who focuses on the mechanics of the land, rocks, and soils in the building process.
- **Geospatial Information Scientist** – Geospatial Information Scientists research geospatial data or develop geospatial technologies.

Multimedia Resources

- Volcanic Eruptions Story Map, <https://nasa.maps.arcgis.com/apps/MapSeries/index.html?appid=3ac5d35d5101407d9e390d83538dddcf>
- My NASA Data, <https://mynasadata.larc.nasa.gov/>
- Smithsonian Institution National Museum of Natural History Global Volcanism Program, <https://volcano.si.edu/>
- USGS Volcanic Ashfall Impacts Working Group, https://volcanoes.usgs.gov/volcanic_ash/ash_gas.html

Materials/Resources Needed

Per Student:

- “Volcanic Eruptions Story Map Datasheet”

Per Group:

- Laptop
- Internet Access

Key Vocabulary

- Aerosol
- Ash
- Plate Tectonics
- Volcano

Background Information

A **volcano** is an opening on the surface of Earth that allows material warmer than its surroundings to escape from its interior. When this material escapes, it causes an eruption. An eruption can be explosive, sending material high into the sky, or it can be calmer, with gentle flows of material. Volcanoes can be active, dormant, or extinct. Active volcanoes are volcanoes that have had recent eruptions or are expected to have eruptions in the near future. Dormant volcanoes no longer produce eruptions, but might again sometime in the future. Extinct volcanoes will likely never erupt again. Volcanoes occur when material significantly warmer than its surroundings is erupted onto the surface of a planet or moon from its interior. On Earth, the erupted material can be liquid rock ("lava" when it's on the surface, "magma" when it's underground), ash, cinders, and/or gas.



Prerequisite Student Knowledge

- Familiarity with finding coordinates on a map
- Familiarity with line plots
- Familiarity with trends in data